

CLAIMS

1. A transfer mechanism of a blow molding apparatus that receives preforms, blow-molded products, or mandrels transported at a first feed pitch along a first circular transportation passage, changes a feed pitch from the first feed pitch to a second feed pitch while transporting the preforms, blow-molded products, or mandrels along a second circular transportation passage, and transfers the preforms, blow-molded products, or mandrels to a third circular transportation passage, comprising:
 - a turntable;
 - 10 a circular guide rail fixed to a surface of the turntable so that a center thereof is at a rotational center of the turntable;
 - a plurality of sliders capable of sliding along the circular guide rail;
 - holding parts formed on the respective sliders for holding the preforms, blow-molded products, or mandrels;
 - 15 pivot pins that are rotatably disposed at intervals of a fixed angle on a circle that is concentric with the rotational center of the turntable in an inside position of the circular guide rail on the turntable;
 - a plurality of swinging arms that swing along a surface of the turntable about the respective pivot pins as the turntable rotates; and
 - 20 slide-type linking parts that link swinging ends of the swinging arms to the respective sliders so as to allow the sliders to slide in an axial direction of the swinging arms.
2. A transfer mechanism of a blow molding apparatus according to Claim 1,
 - 25 comprising a swinging cam mechanism that causes the swinging arms to swing as the turntable rotates,
 - wherein the swinging cam mechanism includes arms extending in a perpendicular direction from the respective pivot pins, cam followers attached to front ends of the arms,

and a fixed disc formed with a cam groove along which the cam followers slide.

3. An inverting transfer mechanism of a blow molding apparatus for receiving preforms or blow-molded products that are upright or inverted and are transported along a first circular transportation passage, inverting a posture of the preforms or blow-molded products while transporting the preforms or blow-molded products along a second circular transportation passage, and transferring the preforms or blow-molded products to a third circular transportation passage, comprising:
 - a turntable;
 - 10 cylindrical members that extend radially on a surface of the turntable with a center of rotation of the turntable as a center and are rotatably supported by the turntable;
 - shaft members that extend through hollow portions of the cylindrical members and rotate integrally with the cylindrical members;
 - grippers that are attached to outer ends of the shaft members, are each capable of holding an opening part of the preform or the blow-molded product, and move along the second circular transportation passage when the turntable rotates; and
 - 15 a rotating cam mechanism that causes the cylindrical members to rotate by 180° as the turntable rotates.
- 20 4. An inverting transfer mechanism of a blow molding apparatus according to Claim 3,
 - wherein the rotating cam mechanism comprises:
 - first and second cam followers formed on sliders capable of reciprocal movement in an axial direction of each cylindrical member;
 - 25 first cam grooves, each of which is formed in a spiral across a 180° angle range in an outer circumferential surface of each cylindrical member and along which the respective first cam followers slide; and
 - a second cam groove that is formed in a surface of a fixed disc and along which

the respective second cam followers slide,

wherein a shape of the second cam groove is set so that the sliders move reciprocally in a radial direction in accordance with rotation of the turntable.

5 5. An inverting transfer mechanism of a blow molding apparatus according to Claim 4,

wherein the grippers respectively include a pair of opening/closing arms that are capable of opening and closing,

10 comprising arm opening/closing mechanisms that open and close the opening/closing arms, and

each arm opening/closing mechanism having a sliding cam mechanism that causes a shaft member to slide in an axial direction of the cylindrical member and a link mechanism that converts sliding of the shaft member to an opening/closing operation of the opening/closing arms.

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6. An inverting transfer mechanism of a blow molding apparatus according to Claim 3, 4, or 5,

comprising an inserting/withdrawing mechanism for inserting and withdrawing mandrels into opening parts of the preforms or blow-molded products in an inverted state,

20 wherein the inserting/withdrawing mechanism includes a mandrel support member capable of rising and falling at a position directly below the respective grippers, and a vertical moving cam mechanism that raises and lowers the mandrel support member in accordance with rotation of the turntable.

25 7. A mold opening/closing mechanism of a blow molding apparatus in which a plurality of blow-molding molds are transported along a circular transportation passage with a fixed feed pitch, and each blow-molding molds has a pair of molding dies capable of opening and closing in a lateral direction, comprising:

a turntable on which a plurality of blow-molding molds are mounted at intervals of a fixed angle;

a vertical moving shaft that rises and falls as the turntable rotates;

a slider that slides in a direction perpendicular to an opening/closing direction of the blow-molding molds as the vertical moving shaft rises and falls; and

a pair of operation arms that convert sliding movement of the slider to opening/closing movement of the blow-molding molds.

8. A mold opening/closing mechanism of a blow molding apparatus according to
10 Claim 7,

wherein the vertical moving shaft is disposed between the slider and the pair of molding dies.

9. A mold opening/closing mechanism of a blow molding apparatus according to
15 Claim 8,

comprising left and right mold supporting members that support the respective molding dies; and

a closing mechanism that holds the mold supporting members in a closed state,
wherein the closing mechanism includes a vertical movable stopping pin, pin
holes formed in opening/closing ends of the mold support members into which the
20 stopping pin can be inserted from above, and a lock mechanism for locking the stopping
pin in a state where the stopping pin is withdrawn from the pin holes, and

the locking mechanism includes a concave formed in an outer circumferential
surface of the stopping pin, a ball disposed on the mold support member so as to be
25 capable of fitting into the concave, and a spring member that biases the ball toward the
stopping pin.

10. A blow molding apparatus that includes a preform supplying station for supplying

preforms in an upright state, a heating station for heating the preforms to a suitable temperature condition for blow-molding while transporting the preforms, a blow station for blowing the heated preforms to form blow-molded products, and a collection station for collecting the blow-molded products, comprising:

5 a first circular transportation passage that transports the preforms supplied from the preform supplying station at a first feed pitch;

 a first transfer mechanism that receives the preforms from the first circular transportation passage and changes the feed pitch to a second feed pitch that is wider than the first feed pitch while transporting the preforms along a second circular transportation

10 passage;

 an inverting transfer mechanism that receives the preforms transported at the second feed pitch from the second circular transportation passage, inverts the preforms to an inverted state while transporting the preforms along a third circular transportation passage, and then inserts mandrels into opening parts of the preforms in the inverted state

15 from below;

 a second transfer mechanism that receives, from the third circular transportation passage, the preforms transported in a state where the mandrels are inserted and changes the feed pitch from the second feed pitch to the first feed pitch while transporting the preforms along a fourth circular transportation passage;

20 an arc-shaped transportation passage part that is formed in the heating station and receives the preforms in the state where the mandrels are inserted from the fourth circular transportation passage; and

 a third transfer mechanism that receives the heated preforms from the arc-shaped transportation passage part and changes the feed pitch from the first feed pitch to the second feed pitch while transporting the preforms along a fifth circular transportation passage,

 wherein in the blow station, the preforms transported at the second feed pitch along the fifth circular transportation passage are received by blow-molding molds that are

- transported at the second feed pitch along a sixth circular transportation passage,
the inverting transfer mechanism receives the blow-molded products from the
blow-molding molds, withdraws the mandrels inserted in the opening parts of the
blow-molded products in an inverted state downward while transporting the blow-molded
5 products along the third circular transportation passage, and then inverts the blow-molded
products in an inverted state to an upright state, and
the blow-molded products are collected from the inverting transfer mechanism by
the collection station.
- 10 11. A blow molding apparatus according to Claim 10,
wherein the first, second, and third transfer mechanisms comprise:
a turntable;
a circular guide rail fixed to a surface of the turntable so that a center thereof is at
a rotational center of the turntable;
15 a plurality of sliders capable of sliding along the circular guide rail;
holding parts formed on the respective sliders and hold the performs or
blow-molded products;
pivot pins that are rotatably disposed at intervals of a fixed angle on a circle that is
concentric with the rotational center of the turntable in an inside position of the circular
20 guide rail on the turntable;
a plurality of swinging arms that swing along a surface of the turntable about the
respective pivot pins as the turntable rotates; and
slide-type linking parts that link swinging ends of the swinging arms to the
respective sliders so as to allow the sliders to slide in an axial direction of the swinging
25 arms.
12. A blow molding apparatus according to Claim 11,
comprising a swinging cam mechanism that causes the swinging arms to swing as

the turntable rotates,

wherein the swinging cam mechanism includes arms extending in a perpendicular direction from the respective pivot pins, cam followers attached to front ends of the arms, and a fixed disc formed with a cam groove along which the cam followers slide.

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13. A blow molding apparatus according to Claim 10,

wherein the inverting transfer mechanism comprises:

a turntable;

cylindrical members that extend radially on a surface of the turntable with a center

10 of rotation of the turntable as a center and are rotatably supported by the turntable;

shaft members that extend through hollow portions of the cylindrical members and rotate integrally with the cylindrical members;

grippers that are attached to outer ends of the shaft members, are each capable of holding an opening part of the preform or the blow-molded product, and move along the 15 second circular transportation passage when the turntable rotates;

a rotating cam mechanism that causes the cylindrical members to rotate by 180° as the turntable rotates; and

an inserting/withdrawing mechanism for inserting and withdrawing mandrels into opening parts of the preforms or blow-molded products in an inverted state.

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14. A blow molding apparatus according to Claim 13,

wherein the rotating cam mechanism comprises:

first and second cam followers formed on sliders capable of reciprocal movement in an axial direction of each cylindrical member;

25 first cam grooves, each of which is formed in a spiral across a 180° angle range in an outer circumferential surface of each cylindrical member and along which the respective first cam followers slide; and

a second cam groove that is formed in a surface of a fixed disc and along which

the respective second cam followers slide,

wherein a shape of the second cam groove is set so that the sliders move reciprocally in a radial direction in accordance with rotation of the turntable.

5 15. A blow molding apparatus according to Claim 14,

wherein the grippers respectively include a pair of opening/closing arms that are capable of opening and closing,

further comprising arm opening/closing mechanisms that open and close the opening/closing arms, and

10 each arm opening/closing mechanism having a sliding cam mechanism that causes a shaft member to slide in an axial direction of the cylindrical member and a link mechanism that converts sliding of the shaft member to an opening/closing operation of the opening/closing arms.

15 16. A blow molding apparatus according to Claim 13, 14 or 15,

wherein the inserting/withdrawing mechanism includes a mandrel support member capable of rising and falling at a position directly below the respective grippers, and a vertical moving cam mechanism that raises and lowers the mandrel support member in accordance with rotation of the turntable.

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17. A blow molding apparatus according to Claim 10,

wherein the blow-molding molds are respectively constructed of a pair of molding dies capable of opening and closing in a lateral direction,

25 further comprising a mold opening/closing mechanism for opening and closing the blow-molding molds in the lateral direction, that has:

a turntable on which a plurality of blow-molding molds are mounted at intervals of a fixed angle;

a vertical moving shaft that rises and falls as the turntable rotates;

a slider that slides in a direction perpendicular to an opening/closing direction of the blow-molding molds as the vertical moving shaft rises and falls; and

a pair of operation arms that convert sliding movement of the slider to opening/closing movement of the blow-molding molds.

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18. A blow molding apparatus according to Claim 17,

wherein the vertical moving shaft is disposed between the slider and the pair of molding dies.

10 19. A blow molding apparatus according to Claim 18,

comprising left and right mold supporting members that support the respective molding dies; and

a closing mechanism that holds the mold supporting members in a closed state,

wherein the closing mechanism includes a vertical movable stopping pin, pin

15 holes formed in opening/closing ends of the mold support members into which the stopping pin can be inserted from above, and a lock mechanism for locking the stopping pin in a state where the stopping pin is withdrawn from the pin holes, and

the locking mechanism includes a concave formed in an outer circumferential surface of the stopping pin, a ball disposed on the mold support member so as to be

20 capable of fitting into the concave, and a spring member that biases the ball toward the stopping pin.